

STRONG PROUD
DÉCOUVREZ VOS FORCES



National
Défense

Défense
nationale

Canada

70
~~66%~~

University of Saskatchewan
Department of Computer Science

CMPT 374

Midterm— closed book / open mind
February 16, 00

Total Marks: 50

Time: 50 Minutes

Answer all of the questions in the spaces provided in this exam paper. If you don't have enough space, write on the back of the page, indicating clearly that your answer is continued there. Be sure to **pace** yourself according to the **marks** allotted to each question ... good luck!!!

A	10
B	6
C	5
D	4
E	8
Total	

72

Part A) SQL**(10 Points)**

Please use the following relations when answering the questions of part A.

Relation:

P

PN	PName	Color	Weight	City
P1	Nut	Red	12	London
P2	Bolt	Green	17	Paris
P3	Screw	Blue	17	Rome
P4	Screw	Red	14	London
P5	Cam	Blue	12	Paris
P6	Cog	Red	19	London

Relation:

S

SN	SName	Status	City
S1	Smith	20	London
S2	Jones	10	Paris
S3	Blake	30	Paris
S4	Clark	20	London
S5	Adams	30	Athens

Please write the result (relation) of the following SQL statements in the free space below each query. Each question is worth 2 points !

1)

SELECT SName, Status
FROM S

WHERE City = (SELECT City FROM P WHERE Color = 'Green')

Shizane Station

Send 10

Flora 20

✓

2)

SELECT COUNT(*) AS Places, City
FROM S
GROUP BY City

Place City

7 London

7 Berlin

1 Rome

✓

3)

SELECT DISTINCT Status
FROM S

20

✓

4)

SELECT COUNT(*) AS PLACES, City
FROM S
GROUP BY City
HAVING COUNT(*) > 1
ORDER BY City DESC

PLACES	City
2	Paris
2	London

✓

5)

SELECT *
FROM S
WHERE City < 'Sofia'

ID	SURNAME	SPRINT	CITY
51	Smith	20	London
52	Robert	13	Paris
53	John	7	Paris
54	Robert	7	Paris
55	Robert	20	London

✓

Part B) Relational Algebra

(10 Points)

4 Points

- 1) Name Codd's original eight algebraic operations.

Restriction / Selection \leftarrow
Union \leftarrow
Join (Natural) \leftarrow
Cartesian Product \leftarrow
Aggregation \leftarrow
Intersection \leftarrow
Difference \leftarrow
Projection \leftarrow

⑨

4 Points

- 2) Some of Codd's original eight algebraic operations are considered to be primitive. Name the "non primitive" algebraic operations and redefine one of them by use of the original primitive algebraic operations.

Aggregation

Selection \leftarrow
Projection \leftarrow

Join

Selection \leftarrow
Projection \leftarrow

$\sigma_{A=1}(\pi_{A,B}(R))$

2 Points

- 3) Show how to modify (update) a tuple by use of Codd's original eight algebraic operators.

1. Select the tuple to be updated
2. Select the update operation using the algebraic operators
3. Apply the update operation to the tuple

Part C) Basic Definitions

(10 Points)

1 Point

- 1) What is the meant with the "degree" of a relation?

that attributes



1 Point

- 2) What is meant with the "cardinality" of a relation?

that tuples



2 Point

- 3) Name the two types of data independence.

Physical
Logical

2 Point

WANTED PICTURE

4) Draw and explain the ANSI-SPARC three level architecture.

PICTURE = 1 point
EXPLANATION = 1 point

①
External
- provides the access from the user
Conceptual
- provides a logical view of the data
Internal
- describes the physical layout of the data

2 Points

5) Name the four types of operations supported by the DML.

~~DDL Data Manipulation Language~~

Insertion

Deletion

Update

Selection

2 Points

6) What is the difference between a "view" and a "base relation"?

- A view is a virtual relation that is derived from one or more base relations.

- A view is a virtual relation that is derived from one or more base relations. It is not stored in the database and its data is derived from the base relations.

Part D) The three record based data models **(12 Points)**

Assume that there is a N:M relationship between students and classes e.g. a student can take multiple classes and a class is taken by multiple students. Show how such a N:M relation is modeled in the three record based data models.

3Points

- 1) Show how the N:M student-class relation is treated in a relational data model.**

DRAW THE THREE TABLES.



3 Points

2) Show how the N:M student-class relation is treated in a network data model.



3 Points

3) Show how the N:M student-class relation is treated in a hierarchical data model.

- hierarchical design for 1:M relationship
- must be supported by using multiple pointers to duplicate 1 class

student

class

(CI)

(CI)

- mention pointers, redundancy.

2

3 Points

SHOULD HAVE 1 OR 2 CRITERIA
FOR EACH MODEL.

- 4) Compare the three record based data models (use a table). Name specific strengths and weaknesses of each model.

Strength

Weakness

Simple, easy to understand and use

Supports complex queries

Supports multiple users

Supports complex queries

Supports complex queries, only supports a few types of queries

Supports complex queries, only supports a few types of queries

Part E) Functional dependencies

(8 Points)

5 Points

- 1) Determine the irreducible set of functional dependencies for the following 5 functional dependencies. Please document every step in determining the irreducible set.

$A \rightarrow BC$

$B \rightarrow C$

$A \rightarrow B$

$AB \rightarrow C$

$AC \rightarrow D$

1. $A \rightarrow BC \Rightarrow A \rightarrow B, A \rightarrow C$ decomposition

2. $AC \rightarrow D$

$A \rightarrow C \Rightarrow A \rightarrow AC \Rightarrow A \rightarrow D$ augmentation, transitivity

3. $AB \rightarrow C$

$A \rightarrow B \Rightarrow A \rightarrow AB \Rightarrow A \rightarrow C$ augmentation, transitivity

4. So far we have

$A \rightarrow B$

$A \rightarrow C$

$A \rightarrow C$

$A \rightarrow D$

$B \rightarrow C$

$A \rightarrow B$

5. Remove duplicates

$A \rightarrow B$

$A \rightarrow C$

$B \rightarrow C$

$A \rightarrow D$

6. $A \rightarrow B, B \rightarrow C \Rightarrow A \rightarrow C$

Therefore our irreducible set is:

Therefore our irreducible set is:

$A \rightarrow B, B \rightarrow C, A \rightarrow D$

1 Point

- 2) Which attributes of a relation are functionally depended on the candidate key?

1 Point

- 5) When is a relation in "third normal form"?

1 Point

- 6) What is the purpose of normalization?